

J003 Rec'd PCT/PTO 05 DEC 2001

FORM PTO-1390 (REV 10-94)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		DOCKET #: 4925-178PUS
<b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371</b>				U.S. APPLICATION NO. <b>107009273</b>
INTERNATIONAL APPLICATION NO <b>PCT/FI00/00524</b>		INTERNATIONAL FILING DATE <b>09 June 2000</b>		PRIORITY DATE CLAIMED <b>11 June 1999</b>
TITLE OF INVENTION  <b>Means for Handling High-Frequency Energy</b>				
APPLICANT(S) FOR DO/EO/US <b>Olli SALMELA; Esa KEMPPINEN; Markku KOIVISTO; Hans SOMERMA; Pertti IKÄLÄINEN; Petri SAVOLAINEN</b>				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) a. <input checked="" type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau) (See Reply to Written Opinion). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). <b>Unexecuted</b> 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). <b>Items 11. to 16. Below concern other document(s) or information included:</b> 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input checked="" type="checkbox"/> Other items or information ( <i>specify</i> ): PCT Publication Sheet, Int'l Preliminary Examination Report, PCT Request, PCT Demand, Written Opinion, Reply to Written Opinion, Notice Informing the Applicant of the Communication of the International Application to the Designated Offices, Notice of the Recording of a Change, and Notification Concerning Submission or Transmittal of Priority Document, and Int'l Search Report				

U.S. APPLICATION NO (if known, see 37 CFR 1.5) <div style="font-size: 1.5em; font-weight: bold;">10/009273</div>		INTERNATIONAL APPLICATION NO <b>PCT/FI00/00524</b>		ATTORNEY'S DOCKET NUMBER <b>4925-178PUS</b>			
17.[x]The following fees are submitted:							
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"> <b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b>            Search Report has been prepared by the EPO or JPO .....<b>\$890.00</b>            International preliminary examination fee paid to USPTO (37 CFR 1.482) .....<b>\$710.00</b>            No international preliminary examination fee paid to USPTO (37 CFR 1.482)            but international search fee paid to USPTO (37 CFR 1.445(a)(2)) .....<b>\$740.00</b>            Neither international preliminary examination fee (37 CFR 1.482)            nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....<b>\$1040.00</b>            International preliminary examination fee paid to USPTO (37 CFR 1.482)            and all claims satisfied provisions of PCT Article 33(2)-(4) .....<b>\$100.00</b> </td> <td style="width: 20%;"></td> </tr> </table>						<b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO ..... <b>\$890.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... <b>\$710.00</b> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... <b>\$740.00</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$1040.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... <b>\$100.00</b>	
<b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO ..... <b>\$890.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... <b>\$710.00</b> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... <b>\$740.00</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$1040.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... <b>\$100.00</b>							
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				\$	890		
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$			
Claims	Number Filed	Number Extra	Rate				
Total Claims	11 - 20 =	0	x <b>\$18.00</b>	\$			
Independent Claims	2 - 3 =	0	x <b>\$84.00</b>	\$			
Multiple dependent claim(s) (if applicable)			+ <b>\$280.00</b>	\$			
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$	890		
Reduction of 1/2 for filing by small entity, if applicable.				\$			
<b>SUBTOTAL =</b>				\$	890		
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$			
<b>TOTAL NATIONAL FEE =</b>				\$	890		
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property				\$			
<b>TOTAL FEES ENCLOSED</b>				\$	890		
				Amount to be refunded:	\$		
				charged:	\$		
a. [x]One check in the amount of \$ <u>890</u> to cover the above fee is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. <u>03-2412</u> in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. [x]The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>03-2412</u> . A duplicate copy of this sheet is enclosed.							
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive          (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>							
SEND ALL CORRESPONDENCE TO: <u>Michael C. Stuart</u> Cohen, Pontani, Lieberman & Pavane 551 Fifth Avenue, Suite 1210 New York, New York 10176			<div style="text-align: center;"> </div> <u>Michael C. Stuart</u> Registration Number: <u>35,698</u> <u>December 5, 2001</u> Tel: (212) 687-2770				

By Express Mail # EV052763309US · December 5, 2001

Attorney Docket # 4925-178PUS

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of

Olli SALMELA et al.

International Appln. No.: PCT/FI00/00524

International Filing Date: 09 June 2000

For: Means for Handling High-Frequency Energy

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231  
**BOX PCT**

S I R:

Prior to examination of the above-identified application please amend the  
application as follows:

In the Specification:

On page 1, before line 3, the paragraph beginning with "The present invention",  
insert the following heading:

**--FIELD OF THE INVENTION--**

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On page 1, before line 7, the paragraph beginning with "High-frequency", insert the following heading:

**--BACKGROUND OF THE INVENTION--**

On page 3, before line 1, the paragraph beginning with "The purpose", insert the following heading:

**--SUMMARY OF THE INVENTION--**

On page 3, before line 22, the paragraph beginning with "In the following", insert the following as a new paragraph:

--Other objects and features of the present invention will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are intended solely for purposes of illustration and not as a definition of the limits of the invention, for which reference should be made to the appended claims.

**BRIEF DESCRIPTION OF THE DRAWINGS --**

On page 4, before line 3, the paragraph beginning with "Figures 1 and 2", insert the following heading:

**--DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS--**

On page 6, after line 7 (last line), insert the following as a new paragraph:

--Thus, while there have been shown and described and pointed out fundamental novel features of the present invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices described and illustrated, and in their operation, and of the methods described may be made by those skilled in the art without departing from the spirit of the present invention. For example, it is expressly intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.--

On page 13, line 1, delete "Claims" and insert therefor --What is claimed is:--.

In the Claims:

Amend claims 5 and 6 to read as follows:

5. A handling means according to Claim 3, being a Wilkinson divider.
6. A handling means according to Claim 3, being a Wilkinson combiner.

Add the following new claims:

10. A handling means according to Claim 4, being a Wilkinson divider.
11. A handling means according to Claim 4, being a Wilkinson combiner.


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**REMARKS**

This preliminary amendment is presented to place the application in proper form for examination and to eliminate multiple dependency from the present claims. No new matter has been added. Early examination and favorable consideration of the above-identified application is earnestly solicited.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,  
COHEN, PONTANI, LIEBERMAN & PAVANE

By:   
Michael C. Stuart  
Reg. No. 35,698  
551 Fifth Avenue, Suite 1210  
New York, N.Y. 10176  
(212) 687-2770

5 December 2001

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AMENDMENTS TO THE SPECIFICATION AND CLAIMS SHOWING CHANGES

In the Claims:

5. A handling means according to Claim 3 [or 4], being a Wilkinson divider.
6. A handling means according to Claim 3 [or 4], being a Wilkinson combiner.

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**Means for handling high-frequency energy**

The present invention relates to structures, by which part of the incoming high-frequency energy can be separated to its own path or energies coming from different paths can be combined to a common path. Means like this are needed in units connected to the base station antennas of mobile networks, for example.

High-frequency dividing means include power dividers and directional couplers. In a power divider, the incoming energy is divided to two or more output paths so that the powers of the branches are usually equally high. A common divider type is the Wilkinson divider, by which the energy can be divided to several output paths as matched and with relatively small losses. The directional coupler has four ports: The energy coming to the input port is mostly directed to a second port, a relatively small part of the incoming energy is directed to the third port, and hardly any energy goes to the fourth port.

In practice, the dividing means are mostly realized by using microstrips. Figure 1 shows an example of such a prior art structure. This is a four-branch Wilkinson divider, which is manufactured in an ordinary circuit board. The circuit board includes a dielectric board 101, on the lower surface thereof a conductor plane 102 connected to the signal ground, and on the upper surface a microstrip 103. The characteristic impedance of the transmission line formed by these parts is  $Z_0$ , which is the same as the impedance of the feed line of the structure. The strip 103 is branched into four microstrips 111, 112, 113 and 114. Their length is  $\lambda/4$  at the operating frequency, and each of them forms an impedance  $Z_0/\sqrt{4} = Z_0/2$  with the board 101 and the ground plane 102. A discrete resistor 121, the resistance of which is  $Z_0$ , is connected to the second end of the microstrip 111. Correspondingly, similar resistors 122, 123 and 124 are connected to the second ends of the strips 112, 113 and 114, respectively. The second ends of the resistors are connected together with a conductor 105, which consists of three jumper wires. If a multilayer board were used, a strip inside the board 101 would correspond to the conductor 105. The microstrip 111 continues from the connecting point of the resistor 121 onward as a narrower microstrip 131, which forms an impedance  $Z_0$  with the board 101 and the ground plane 102. The microstrip 131 leads to the first output out1. The strips 112, 113 and 114 continue in the same way. They lead to the outputs out2, out3 and out4. The structure has the drawback that the connecting of the discrete components requires joints on the board, which means reduced reliability.

A structure corresponding to that shown in Fig. 1 can also be implemented by thin-film technology, whereby the resistive components are formed by sputtering, for example. A structure like this has the drawback that its costs, including encapsulation, are relatively high.

- 5 A simple directional coupler can be made by arranging another conductor in parallel with the signal strip conductor on the surface of a dielectric board, the other side of which acts as the ground plane. This structure has the drawback that its directional properties are relatively poor. A structure with better directional properties is obtained when both strips are arranged inside a dielectric board, both sides of which
- 10 are ground planes. A tighter electromagnetic coupling compared to both structures is obtained e.g. by the so-called Lange coupler. Fig. 2 shows the Lange coupler in the prior art form. It has three conductor areas on the surface of a dielectric board. The first conductor area comprises a quarter-wave long, strip-like center conductor 201, a first strip extension 202 and a second strip extension 203. The extensions 202 and
- 15 203 reach from the opposite ends of the structure to the middle of the center conductor 201. The ends of the extensions are connected with conductor wires 221 and 222 to the midpoint of the center conductor. The second conductor area comprises a quarter-wave long strip conductor 211, which runs beside the center conductor, between it and the first extension 202. The third conductor area
- 20 comprises a quarter-wave long strip conductor 212, which runs beside the center conductor, between it and the second extension 203. The center conductor 201 remains between the conductor strips 211 and 212. The conductor strips 211 and 212 are connected to each other with conductor wires 223 and 224 at the opposite ends of the structure. The structure is a four-port. Port 1 is linked with the end of the
- 25 conductor 211, which is not between the extension 202 and the center conductor. Port 2 is linked with the end of the conductor 212, which is not between the extension 203 and the center conductor. Port 3 is linked with the branching point of the center conductor and the extension 203. Port 4 is linked with the branching point of the center conductor and the extension 202. Each port also includes the ground
- 30 plane, which is not drawn in Fig. 2. The signal is fed to port 1, for example. Then most of the energy fed in comes out from port 2. Part of the incoming energy is transferred to port 3. This part is relatively small. Instead, hardly any energy is transferred to port 4. The drawback of the Lange coupler is the joints required by the jumper wires, which mean reduced reliability and an increase in manufacturing
- 35 costs. In addition, the surface area required is relatively large, because the conductor strips are placed on the same level.

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The purpose of the invention is to reduce the above mentioned drawbacks of the prior art. The means according to the invention is characterized in what is set forth in the independent claim. Some preferred embodiments of the invention are presented in the dependent claims.

- 5 The basic idea of the invention is the following: All parts of the dividing means are integrated into a monolithic structure in an insulating material, preferably multilayer ceramics. The transmission line strips and other conductors are formed by printing conductive material on the outer surface of the ceramic piece and in its interlayers, when required. The conductors between the surfaces are formed by filling the hole  
10 made through the layer or layers with conducting material. The resistive components parallel with and between the surfaces are formed in a similar manner.

- The invention has the advantage that the dividing means becomes reliable. Another advantage of the invention is the fact that the manufacturing costs of the dividing means are relatively low. Both of these advantages are due to the monolithic  
15 structure, in which no wire joints are needed. Yet another advantage of the invention is the fact that the structure according to it can be fitted in a relatively small space, because structural parts can be placed on top of each other in the insulating material, and also vertically inside the board. Furthermore, the invention has the advantage that the transmission lines, in which the TEM (transversal electromagnetic) wave,  
20 which is advantageous for the coupling, propagates, can be manufactured in a relatively simple manner.

In the following, the invention will be described in more detail. Reference will be made to the accompanying drawings, in which

- Figure 1 shows an example of a prior art divider,  
25 Figure 2 shows an example of a prior art coupler,  
Figure 3a shows an example of a divider according to the invention,  
Figure 3b shows a cross-section of the structure of Fig. 3a,  
Figure 4a shows another example of a divider according to the invention from the top,  
30 Figure 4b shows the divider of Fig. 4a from below,  
Figure 5 shows an example of a coupler according to the invention,

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Figure 6a shows another example of a coupler according to the invention, and

Figure 6b shows the second main part of the coupler shown in Fig. 6a.

Figures 1 and 2 were already described in connection with the description of the prior art.

- 5 Figures 3a and 3b show an example of a divider according to the invention. It has corresponding structural parts as the structure of Fig. 1, i.e. it is a four-branch Wilkinson divider. In Figure 3a, the divider is drawn in a similar manner as in Fig. 1, and Fig. 3b shows the section A-A at the resistive structural parts 321, 322, 323 and 324. In this case, the dielectric board 301 is ceramic. The essential difference  
10 compared to Fig. 1 is the implementation of resistive structural parts included in the divider. According to the section A-A, the resistive structural parts 321, 322, 323 and 324 are composed of resistive masses that solidly fill the holes in the ceramic structure. Such a through hole in the board is called 'via' in this specification. The lower ends of the resistive parts are combined with a conductor 305 on the lower  
15 surface of the board 301. The conductor 305, as well as the ground plane insulated from the conductor 305 on the lower surface, and the conductors on the upper surface of the board are formed with the printing technique in this example. In this way, the structure becomes a monolithic piece. Compared to the structure of Fig. 1, reliability increases and manufacturing costs are reduced, because there are no  
20 discrete components and jumper wires. In this description and especially in the claims, a monolithic piece means a solid body, in which the removal of a structural part of the body would essentially break this body. For example, an electronic circuit integrated into silicon is a monolithic piece. In contrast, a board on which a discrete component has been glued, or a conductor wire has been soldered or  
25 welded, is not a monolithic piece, because a joint like this can be dismantled without breaking the piece and be made again.

- Figures 4a and 4b show another example of an implementation according to the invention, corresponding to Fig. 1. Fig. 4a shows the structure from above, and Fig. 4b from below. The difference compared to the implementation of Fig. 3 is the fact  
30 that the resistive structural parts of the Wilkinson divider are formed by printing on the lower surface of the ceramic board 401. On the surface of the board there are, according to Fig. 4b, the resistive parts 421, 422, 423 and 424 and a conductor 405, which connects together the ends of these parts. The other ends of the resistive parts, which are upper in the figure, are connected to the ends of the quarter-wave  
35 conductors of the divider by a similar "via" technique, by which the resistive parts

are formed in Fig. 3. In figures 4a and 4b, the holes have been filled with conductor material. For example, via 444 is a conductor, which connects the resistive part 424 to the conductor 414 of the transmission line. The ground plane of the transmission lines, which is in the interlayer of the ceramic board, is not shown in figures 4a and 4b.

The dividing means described above was a Wilkinson divider, which distributes high-frequency energy to several transmission paths. It could also be a means used in an inverse manner, a Wilkinson combiner. In addition, the manner of implementation need not be according to Wilkinson in either case.

- 10 Figure 5 shows an example of an implementation of the invention corresponding to the Lange coupler shown in Fig. 2. The idea is that the conductor patterns required by the coupler are placed in different layers of the multilayer board to prevent jumper wires. Figure 5 shows a continuous conductor pattern 531, which is situated in a layer of the board, and a continuous conductor pattern 532 situated in lower layer of the board compared to the previous one. When compared to Fig. 2, the conductor pattern 531 replaces the strip conductors 201, 202 and 203 and the conductor wires 221 and 222 with their joints. The conductor pattern 532 again replaces the strip conductors 211 and 212 and the conductor wires 223 and 224 with their joints. Figure 5 shows the corresponding ports 1 to 4 as in Fig. 2. The ground plane, which is needed both above and below the structure shown in the figure, is not shown. The use of two ground planes entails the extra feature that the electromagnetic field created in the lines is of the TEM form, which is advantageous for the efficiency of the directional coupling. The structure described above can be manufactured besides by using a ceramic board and printing technique also by using an ordinary multilayer circuit board, for example.

- When the multilayer technique is used in the above described manner, the Lange coupler and the corresponding circuits can be implemented as a monolithic structure without jumper wires. Another advantage of the multilayer technique is the fact that the surface area required by the structure can be reduced as compared to the situation that the whole circuit would be on the same level. This is shown by Figures 6a and 6b. In Fig. 6a, the conductor pattern 631 corresponds to the conductor pattern 531 in Fig. 5, and the conductor pattern 632 corresponds to the conductor pattern 532 in Fig. 5. The difference compared to Fig. 5 is the fact that the conductors of different layers are placed on a narrower area and on top of each other. When the conductors are on top of each other, a tighter coupling can be accomplished between them.

Some solutions according to the invention have been described above. However, the invention is not limited to these solutions only. The energy divider/combiner can be of the T-junction type, for example. The shape and mutual location of two strips, between which there is an electromagnetic coupling, can vary substantially. The  
5 structure can be a so-called hybrid, in which case it has a closed circuit composed of quarter-wave long parts. The inventive idea can be applied in many ways within the scope defined by the independent claim.

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## Claims

1. A means for handling high-frequency energy, which comprises a dielectric board having at least two strip conductors, between which there is a coupling, at least one hole filled with conductive material and at least one resistive structural part, **characterized** in that the handling means form a monolithic piece.
2. A handling means according to claim 1, **characterized** in that said dielectric board (301, 401) is ceramic, and said strip conductors (303, 311) have been processed on its surface.
3. A handling means according to Claim 2, **characterized** in that said resistive structural part (321) is formed of said conductive material filling up a hole in the ceramic board.
4. A handling means according to Claim 2, **characterized** in that said resistive structural part (421) is formed of material processed on the surface of the ceramic board and is in series with said conductive material filling up a hole in the ceramic board.
5. A handling means according to Claim 3 or 4, **characterized** in that it is a Wilkinson divider.
6. A handling means according to Claim 3 or 4, **characterized** in that it is a Wilkinson combiner.
7. A means for handling high-frequency energy, which comprises a multilayer dielectric board having at least two strip conductors, between which there is a electromagnetic coupling, **characterized** in that the handling means forms a monolithic piece, and at least two conductors (531; 631; 532; 632) of said strip conductors are located in different interlayers of the multilayer board on top of each other to arrange said electromagnetic coupling.
8. A handling means according to Claim 7, **characterized** in that on two surfaces of said multilayer board there is a conductive plane so that said strip conductors are in the layers between these planes to form transmission lines suitable for TEM waves.
9. A handling means according to Claim 8, **characterized** in that it is a Lange coupler.

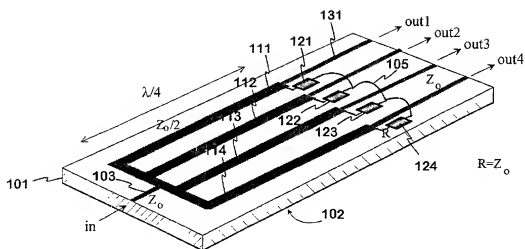


Fig. 1

## PRIOR ART

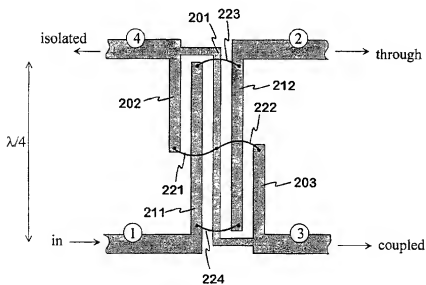


Fig. 2

## PRIOR ART

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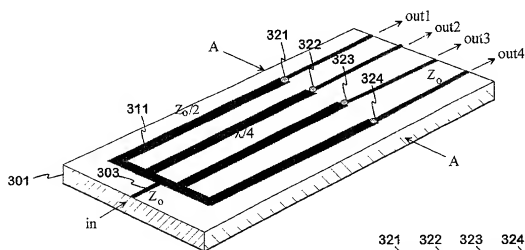


Fig. 3a

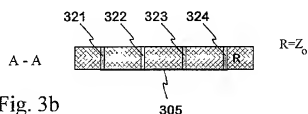


Fig. 3b

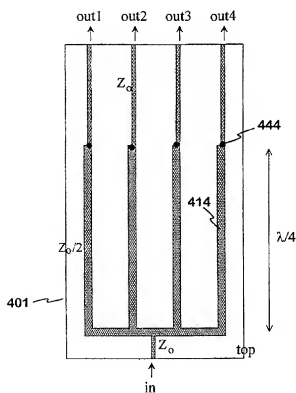


Fig. 4a

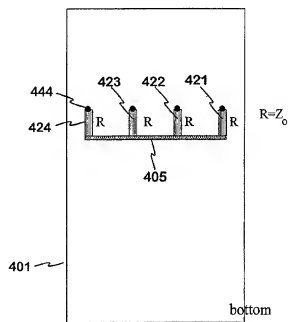


Fig. 4b

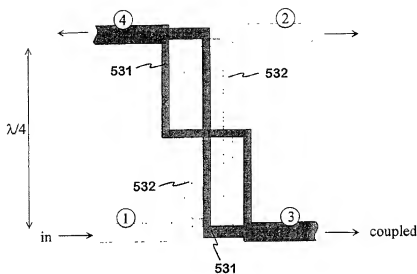


Fig. 5

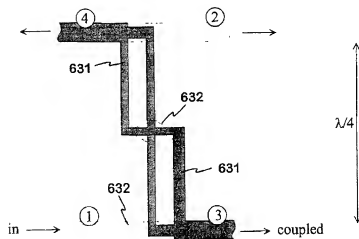


Fig. 6a

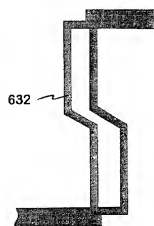


Fig. 6b

NC 18128

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
Includes Reference to PCT International Applications

Attorney's Docket No.  
4925-178PUS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**MEANS FOR HANDLING HIGH-FREQUENCY ENERGY**

the specification of which (check only one item below)

☐ is attached hereto

☒ was filed as United States application

Serial No. 10/009,273

on 5 December 2001

and was amended

on    (if applicable).

☒ was filed as PCT international application

Number PCT/FI00/00524

on 09 June 2000

and was amended under PCT Article 19

on    (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

**PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119
Finland	991341	11 June 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PCT	PCT/FI00/00524	09 June 2000	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

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**Combined Declaration for Patent Application and Power of Attorney (Continued)**  
(Includes Reference to PCT International Applications)

Attorney's Docket No.  
**4925-178PUS**

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (check one)		
U S APPLICATION NUMBER	U S FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U S SERIAL NUMBERS ASSIGNED (if any)		
PCT/FI00/00524	09 June 2000		X	

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (*List name and registration number*)

MYRON COHEN, Reg. No. 17,358; THOMAS C. PONTANI, Reg. No. 29,763; LANCE J. LIEBERMAN, Reg. No. 28,437; MARTIN B. PAVANE, Reg. No. 28,337; MICHAEL C. STUART, Reg. No. 35,698; KLAUS P. STOFFEL, Reg. No. 31,668; EDWARD WEISZ, Reg. No. 37,257; VINCENT M. FAZZARI, Reg. No. 26,879; JULIA S. KIM, Reg. No. 36,567; ALFRED FROEBRICH, Reg. No. 38,887; ALFRED H. HEMINGWAY, JR., Reg. No. 26,736; KENT H. CHENG, Reg. No. 33,849; YUNLING REN, Reg. No. 47,019; ROGER S. THOMPSON, Reg. No. 29,594; BRICE FALLER, Reg. No. 29,532; DAVID J. ROSENBLUM, Reg. No. 37,709; TONY CHEN, Reg. No. 44,607; ELI WEISS, Reg. No. 17,765.

Send correspondence to:  
Michael C. Stuart  
Reg. 35,698  
Cohen, Pontani, Lieberman & Pavane  
551 Fifth Avenue, Suite 1210  
New York, New York 10176

Direct Telephone calls to:  
(name and telephone number)  
Michael C. Stuart  
(212) 687-2770

201	FULL NAME OF INVENTOR	FAMILY NAME <u>SALMELA</u>	FIRST GIVEN NAME <u>Olli</u>	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY <u>Helsinki</u>	STATE OR FOREIGN COUNTRY <u>Finland</u> <b>FIX</b>	COUNTRY OF CITIZENSHIP <u>Finland</u>
	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Hälskäranta 1 D</u> <u>Bajalandentie 9 B 35</u>	CITY <u>Helsinki</u>	STATE & ZIP CODE/COUNTRY <u>FIN-00200 Finland</u>
202	FULL NAME OF INVENTOR	FAMILY NAME <u>KEMPPINEN</u>	FIRST GIVEN NAME <u>Esa</u>	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY <u>Helsinki</u>	STATE OR FOREIGN COUNTRY <u>Finland</u> <b>FIX</b>	COUNTRY OF CITIZENSHIP <u>Finland</u>
	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Vermorinne 17</u>	CITY <u>Helsinki</u>	STATE & ZIP CODE/COUNTRY <u>FIN-00370 Finland</u>

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**Combined Declaration for Patent Application and Power of Attorney (Continued)**  
(Includes Reference to PCT International Applications)

**Attorney's Docket No.**  
**4925-178PUS**

203	FULL NAME OF INVENTOR	FAMILY NAME <u>KOIVISTO</u>	FIRST GIVEN NAME <u>Markku</u>	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY <u>Espoo</u>	STATE OR FOREIGN COUNTRY <u>Finland</u> <i>FIX</i>	COUNTRY OF CITIZENSHIP <u>Finland</u>
	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Nätkatu 3 C Taavinharju 2 E</u>	CITY <u>Espoo</u>	STATE & ZIP CODE/COUNTRY <u>FIN-02200 Finland</u> <u>02180</u>
204	FULL NAME OF INVENTOR	FAMILY NAME <u>SOMERMA</u>	FIRST GIVEN NAME <u>Hans</u>	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY <u>Veikkola</u>	STATE OR FOREIGN COUNTRY <u>Finland</u> <i>FIX</i>	COUNTRY OF CITIZENSHIP <u>Finland</u>
	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Makelantie 1</u>	CITY <u>Veikkola</u>	STATE & ZIP CODE/COUNTRY <u>FIN-02880 Finland</u>
205	FULL NAME OF INVENTOR	FAMILY NAME <u>IKALAINEN</u>	FIRST GIVEN NAME <u>Pertti</u>	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY <u>Huhmari</u>	STATE OR FOREIGN COUNTRY <u>Finland</u> <i>FIX</i>	COUNTRY OF CITIZENSHIP <u>Finland</u>
	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Pähkinälehto 27</u>	CITY <u>Huhmari</u>	STATE & ZIP CODE/COUNTRY <u>FIN-03150 Finland</u>
206	FULL NAME OF INVENTOR	FAMILY NAME <u>SAVOLAINEN</u>	FIRST GIVEN NAME <u>Petri</u>	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY <u>Espoo</u>	STATE OR FOREIGN COUNTRY <u>Finland</u> <i>FIX</i>	COUNTRY OF CITIZENSHIP <u>Finland</u>
	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Kotikontti 14 Lydekuja 3 A</u>	CITY <u>Espoo</u>	STATE & ZIP CODE/COUNTRY <u>FIN-02200 Finland</u>
207	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
208	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
209	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

**Combined Declaration for Patent Application and Power of Attorney (Continued)**  
(Includes Reference to PCT International Applications)

**Attorney's Docket No.**  
**4925-178PUS**

2 1 0	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
2 1 1	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
2 1 2	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201 <i>Chris Salcedo</i>	SIGNATURE OF INVENTOR 202 <i>Eric M. H. H.</i>	SIGNATURE OF INVENTOR 203 <i>Eric M. H. H.</i>
DATE 15.1.2002	DATE 14.1.2002	DATE 14.1.2002
SIGNATURE OF INVENTOR 204 <i>Eric M. H. H.</i>	SIGNATURE OF INVENTOR 205 <i>Eric M. H. H.</i>	SIGNATURE OF INVENTOR 206 <i>Eric M. H. H.</i>
DATE 14.1.02	DATE 7.1.02	DATE 17.1.2002
SIGNATURE OF INVENTOR 207	SIGNATURE OF INVENTOR 208	SIGNATURE OF INVENTOR 209
DATE	DATE	DATE
SIGNATURE OF INVENTOR 210	SIGNATURE OF INVENTOR 211	SIGNATURE OF INVENTOR 212
DATE	DATE	DATE